quent. The plains of Southern Russia, or of the Red River in Canada, with a comparatively rigorous climate, far excel Ireland as wheat-producing countries, because their short summer is one of uninterrupted fierce sunshine; their vegetation suffers no check; the grain is ripened all at once, and the harvest gathered without delay or difficulty. The deficiency of ripening power in the Irish climate produces a secondary defect, which meets with less attention than it deserves. The grain which lingers on the stem two or three months before it hardens is sure to be unequally ripened; some of it is immature, while more is tending to decay. Consequently, it is bad seed, and the Irish farmer habitually sows perhaps six or eight times as much as Mr. Mechi would deem requisite. Under these circumstances, it is evident that the Irish farmer ought to cultivate cereals no further than is requisite for the economy of his farm, and to look to other productions for his profit. Fortunately, there is a husbandry for the pursuit of which he enjoys peculiar advantages. In green crops no country can compete with Ireland, where, nevertheless, they are still little known or esteemed by the multitude. From this it may be inferred that sheep and cattle ought to be the chief objects of Irish husbandry. In truth, the Green Isle, under proper management, could easily supply England with beef, mutton, poultry, milk, and butter, and grow rich by giving abundance at a cheap rate to her neighbours. But then this could be effected only under a system of large farms. The grazier and cattle dealer, to make their business profitable, must do it on a large scale. Butter of the best quality cannot come from a small dairy. The improvement of Ireland, therefore, as dictated by climate and natural capability, can be effected only under a system of large farms. The popular wish, however, is for small holdings. It is thought that the country, when divided into potato gardens and all covered with cottages, will be a paradise. But this poor man's paradise, beginning with a few years of felicity, will assuredly lead to the pauperism of ages. The Legislature cannot countenance schemes opposed to the wholesome development of society, and which would make poverty an institution; neither can it prevent their diffusion; but it may counteract them by spreading enlightenment and by presenting plain truths to the common sense of the community. This might be done by the publication of some statistics, showing the relative amount of cost and production of wheat and of green crops in England and Ireland, with some illustrations of the gain derivable from large farms and the use of machinery. W. D. C.

THE STONE AGE IN EGYPT

At a recent meeting of the French Academy, two communications were read relative to the discovery of relics presumably belonging to the Stone Age in Egypt. The one of these was merely a claim on the part of M. Arcelin to priority in the discovery of various localities abounding in such remains. The other, by Messrs. Hamy and Lenormant, while according priority in the discovery to M. Arcelin, gives a list of the various spots at present known in Egypt on which the manufacture of flint implements was carried on in early times—or where *ateliers de fabrication* have been discovered. For the benefit of our countrymen travelling in Egypt, we here reproduce the list, arranged in the order in which the places occur in travelling southwards.

1. SAQQARAH, where have been found "scrapers" and other worked flints.

2. NEG-SALMANI, a small *atelier* in the desert, at some distance from the Libyan chain, and to the north of the ruins of Abydos. Flakes of whitish flint have been observed here.

3. HARABAT-EL-MADFOUNEH, another small *atelier* to the west of the great temple of Seti I., at the foot of the mountain. The worked flints, principally flakes, are of a fine texture, and pink in colour.

4. BAB-EL-MOLOUK, at the entry of the Valley of the Tombs. M. Arcelin here found flakes, "scrapers," &c.

5. GEBEL-QOURNAH. Here are traces of the manufacture on a large scale of worked flints of various types. Among these are said to be "lance-heads" of a curious character, like some of those from the Valley of the Somme, and the Cave of Le Moustier, arrowheads, knives with or without a shoulder, "scrapers," hammer-stones, and nuclei, not unlike those of Pressigny. The flint is brown or blackish, and fine in texture.

6. DEIR-EL-BAHARI, and 7, DEIR-EL-MEDINEH, at the foot of the mountain of Thebes. Nuclei and flakes, like those of Gebel-Qournah, are found here occasionally, and it is suggested may have come from some unexplored locality on the summit.

8. EL-KAB, where, at the foot of the cliff, flakes, arrowheads, and other forms have been found.

Besides these localities, where worked flints occur on the surface of the soil, there is ABOU-MANGA, where the containing bed is not superficial, and some spots in the plain of Thebes, where MM. Hamy and Lenormant have found implements comparable in type with those of St. Acheul, and in connection with the old alluvia of the Nile, the relative date of which has, however, not been fixed.

It is stated that the instruments are not all of flint, but in some cases of porphyry, amphibolic rock, or other hard kinds of stone. J. EVANS

THE PROJECTED CHANNEL RAILWAYS

III.

We have already considered two modes of crossing the English Channel by a railway, viz. one above the water by a bridge, and another below the water by a tunnel through the chalk. The two shores might be also connected by a submerged roadway passing direct through the water. It might be constructed either on the bottom of the channel or at a certain distance below the level of the sea. Submerged roadways have been proposed, some of iron, others of concrete; of the former of these we shall only consider such schemes as appear to have received sufficient attention from their originators.

These structures may be simply called tubes, because of their circular shape, which is, we all know, the most favourable form to resist pressure against collapse. The various propositions for the construction of iron tubes may be divided in two classes, viz.: 1st, schemes in which the parts of the proposed submerged tube are to be constructed on shore in certain lengths, afterwards to be united under water to form the permanent structure. 2nd, Schemes in which the whole tube is to be at once built in deep water.

Among the designs which belong to the first class, the best and most elaborate is that of the late Mr. Chalmers. His design is well known from his publication on the Channel Railway, which we consider a meritorious and ingenious production. He proposes a line of tube between the South Foreland and Blanc-Nez on the French coast, with a gigantic tower—or ventilator, as he terms it—midway in the channel in thirty fathoms of water. Having made this tower, he proposes to construct wrought-iron tubes on shore, each about 400 feet long, closed at both ends by watertight bulkheads. These tubes are to be floated, one by one, to the tower, and to be there submerged, "being drawn down by means of endless chains passing round pulleys or drums attached to massive anchor boxes on the bottom of the Channel." The separate parts to be submerged at one operation are to have each a floating-power equal to about 100 tons. A short description is also given how the ends of the tube about to be submerged should be drawn and attached to that part already permanently secured to the tower and the bottom of the Channel.

The deep sea tower or ventilator is probably not practicable, but we consider it does not form an essential part of the scheme. The whole tube might be formed of 240 separate pieces, each 400 feet long, and submerged without the tower by working from one shore end. The submerging and joining together of these parts in deep water would, however, be a perilous operation. No doubt this is the main difficulty of every plan of this class of scheme. In the present case it must be overcome and the operation 240 times successfully repeated, in order to complete the structure, and we may accordingly appreciate the chance in favour of the completion of this kind of submerged roadway.

Of the second class of works, viz. building the whole tube in deep water, we have but one scheme. It is the more satisfactory to observe that, of all the schemes which have been proposed with a view to establish a permanent railway communication between England and France, it is the most elaborate and complete, offering a solution on all material points in connection with this subject. The authors of this project—Messrs. Bateman and Révy—have published a full account of their scheme, and we cannot do better than refer to their work for a short description of the plan they adopt.

Our object has been to devise a scheme by which all difficulties of operating in water should be avoided. We propose to lay a tube of cast iron on the bottom of the sea, between coast and coast, to be commenced on one side of the Channel, and to be built up within the inside of a horizontal cylinder, or bell, or chamber, which shall be constantly pushed forward as the building up of the tube proceeds. The bell or chamber within which the tube is to be constructed will be about 80 ft. in length, 18 ft. internal diameter, and composed of cast-iron rings 8 inches thick, securely bolted together. The interior of the bell will be bored out to a true cylindrical surface, like the inside of a steam cylinder. The tube to be constructed within it will consist of cast-iron plates in segments 4 in. in thickness, connected by flanges, bolted together inside the tube, leaving a clear diameter of 13ft. when finished. Surrounding this tube and forming part of it, will be constructed annular discs or diaphragms, the outside circumference of which will accurately fit the interior of the bell. These diaphragms will be furnished with arrangements for making perfectly watertight joints for the purpose of excluding sea water and securing a dry chamber, within which the various operations for building up the tube, and for pressing forward the bell as each ring of the tube is added, will be performed. Within this chamber, powerful hydraulic presses, using the built and completed portion of the tube as a fulcrum, will, as each ring is completed, push forward the bell to a sufficient distance to admit the addition of another ring to the tube. The bell will slide over the watertight joints described, one of which will be left behind as the bell is projected forward, leaving three always in operation against the sea. The weight of the bell and of the machinery within it will be a little in excess of the weight of water displaced, and therefore the only resistance to be overcome by the hydraulic presses when pushing forward the bell, is the friction due to the slight difference in weight and the head or column of water pressing upon the sectional area of the bell against its forward motion. In like manner, the specific gravity of the tube will be a little in excess of the weight of water which it displaces; and in order to obtain a firm footing upon the bottom of the sea, the tube will be weighted by a lining of brick in cement, and for its further protection will be tied to the ground by screw piles, which will pass through stuffing boxes in the bottom of the tube. These piles will, during the construction of the tube within the bell chamber, be introduced in the annular space between the outside of the tube and the inside of the bell, and will be screwed into the ground as they are left behind by the progression of the bell. The hydraulic presses and the other hydraulic machinery, which will be employed for lifting and fixing the various segments of the tube, will be supplied with the power required for working them from accumulators on shore, on Sir William Armstrong's system, and the supply of fresh air required for the sustenance of the workmen employed within the bell and within the tube will be insured also by steam power on shore. As the tube is completed, the rails will be laid within it for the trains of waggons to be employed in bringing up segments of the rings as they may be required for the constructions of the tube, and for taking back the waste water from the hydraulic presses, or any water from leakage during the construction.

The tube will be formed of rings of 10 feet in length, each ring consisting of six segments, all precisely alike, turned and faced at the flanges or joints, and fitted together on shore previous to being taken into the bell, so that on their arrival the segments may, with perfect certainty and precision, be attached to each other. The building of the tube will be commenced on dry land above the level of the sea, and will be gradually submerged as the tube lengthens. The operations on dry land will be attended with more difficulty than those under water, but all these circumstances have been carefully considered and provided for.

The precise line to be taken betwixt the English and French coasts can hardly be determined without a more minute survey of the bottom of the Channel than at present exists. It will probably be between a point in close proximity to Dover on the English coast, and a point in close proximity to Cape Grisnez on the French coast. On the line suggested the water increases in depth on both sides of the Channel more rapidly than elsewhere, although in no instance will the gradient be more than about 1 in 100. The tube at each end would gradually emerge from the water, and on arriving above the level of the sea would be connected with the existing railway systems, so that the same carriage may travel all the way from London to Paris, or, if Captain Tyler's anticipations be realised, all the way from John O'Groat's to Bombay.

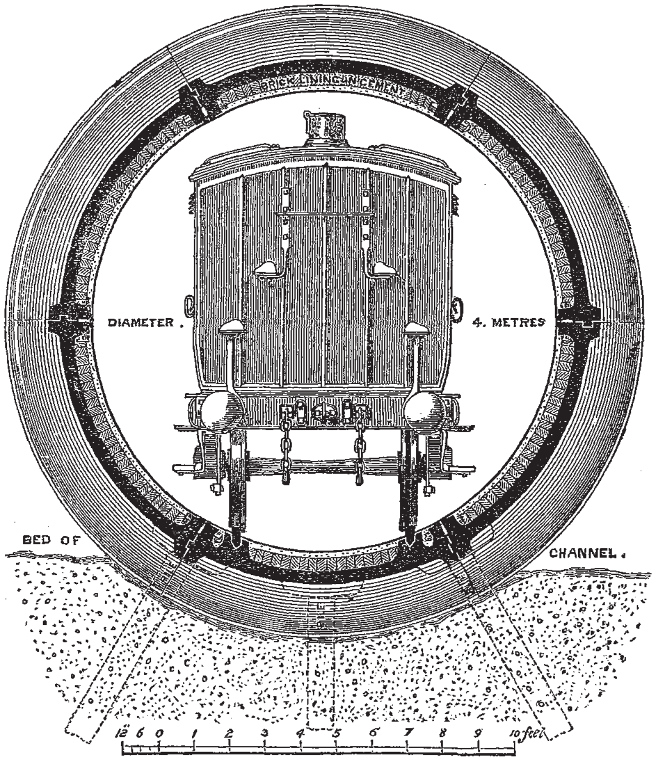
The distance across the Channel on the line chosen is about 22 miles. The tube as proposed is large enough for the passage of carriages of the present ordinary construction, and to avoid the objections to the use of locomotives in a tube of so great a length, and the nuisance which would be thereby created, and taking advantage of the perfect circular form which the mechanical operation of turning, facing, &c., will insure, it is proposed to work the traffic by pneumatic pressure. The air will be exhausted on one side of the train and forced in on the other, and so the required difference of pressure will be given for carrying the train through at any determined speed. Powerful steam-engines, with the necessary apparatus for exhausting and forcing the air into the tube, will be erected on shore at each end; and supposing one tube only to exist, the traffic will be worked alternately in each direction.

It has been found by calculation, that, for moving a large amount of tonnage and a great number of passengers, the most economical arrangement will be to send combined goods and passenger trains through the tube at 20 miles an hour, with occasional express trains at 30 miles an hour. Thus, an ordinary or slow train would occupy about 66 minutes in the transit, and a quick or express train about 45 minutes. In this way the tube, if fully worked, would permit the passage of 16 ordinary slow trains (8 each way), and 6 express trains (3 each way), each conveying both goods and passengers. About 10,000 tons of goods per day, or upwards of 3,000,000 per annum, and 5,000 passengers, or nearly 2,000,000 per annum, might be taken through, or a less amount of goods and a larger number of passengers, or *vice versâ*, if circumstances rendered other proportions necessary or desirable.

The horse power required for working the traffic with the above number of ordinary and express trains will be, on the average, 1,750 indicated, or about 400 nominal horse power at each end.

We should gladly have referred to many other interesting and important statements contained in this work, but our limited space does not admit of our doing so. A general idea of the proposition may be gathered from the above description of the authors, taken from the popular part of their work. The Appendix, which really contains the substance of the scheme, is too elaborate and technical for the general reader, without devoting special study and attention to it. Suffice it to state, that the amount of information conveyed in those 40 pages of close print is very great, being an account of a succession of results of elaborate investigations of physical, mathematical, and even of a chemical nature. One gains confidence from the mere fact, that in treating the subject the authors are evidently "at home," and do not evade a difficulty.

The general principle of the scheme, as invented and elaborated by Messrs. Bateman and Révy, may be easily understood by the ordinary reader. He can, however, have little idea how the practical difficulties attending the execution of such immense works have been overcome by these engineers. Take, for example, the first sentence or two we have quoted above. The general proposition is this: "A tube of cast iron to be built up inside a horizontal cylinder or chamber."—No doubt this may appear simple enough, but when we come to consider what the operation of *building* means,—when we come to consider that no part of the tube to be so built up weighs in one piece less than *ten tons*,—that those solid pieces of iron could not even be stirred by the power of scores of men, much less lifted or deposited in the right place—that this "building up" is to take place in a comparatively small space, not exceeding 13 feet in diameter, the larger part of which is already occupied by the very plate weighing 10 tons;—we may in a measure realise what the word "building" under these circumstances signifies.



SECTION OF THE TUBE.

But we have further to bear in mind, that it is not enough that we should be able somehow to "build up" the tube inside that chamber, but that it must be done quickly, without delay or a hitch, and that unless it could be so done the operation of "building up" would take generations in crossing the Channel, and make the whole proposition, though practicable in every detail, yet a forlorn hope, because of the length of time. If thus we come to consider, that the authors have not contented themselves with saying that "their tube is to be built up in that chamber," but have given us the precise designs and the exact mode of proceeding to be adopted; that the designs and arrangements are so complete that they might be forthwith placed in the hands of a contractor; that these mechanical arrangements would enable a boy of ordinary intelligence to take hold, lift, and place, and finally deposit these monster plates with the same ease, quickness, and certainty as a bricklayer would lay his brick in the construction of an arch, we venture to say the authors have made out their case.

We believe it is the first time that any of the projectors or designers of Channel railways have paid serious attention to the important question, how such a submerged railway or tunnel could be used and worked to advantage for the enormous traffic between England and France. Most of them seem to assume, as a matter of course, that such a tunnel of iron or brick would be worked as ordinary railways. It appears, however, from the investigations of Messrs. Bateman and Révy that there is but one way of working such a tunnel to advantage, and unless the arrangements and the construction of the works be kept in accordance with that mode of working the traffic, the tunnel, when completed, would be of no use for practical purposes. The authors find that the power for the propulsion of trains must be pneumatic pressure; not as applied in the old-fashioned style above ground, and known by the name of atmospheric railways, but a pressure of air applied by powerful pumps directly upon the train, which would form a kind of loose piston inside the tube. On the old plan, the train was outside a little tube; on the new plan, the train is inside a large tube; and with this simple alteration all the difficulties which led to the abandonment of the former, disappear on the latter plan. The difficulties of the old atmospheric railways were: (1) mechanical difficulty of connecting the piston of the little tube with the train outside it; (2) The high pressure required on the small area of the piston for the propulsion of the train, and consequent development of an excessive amount of heat within the pumps, leading to their rapid destruction and great loss of power by subsequent cooling of the air. By the new mode of atmospheric propulsion all these difficulties are done away with, for there is no connection between a piston and the train wanted, and the pressure of the air over the large sectional area of the tube required for propulsion is but a small fraction of that formerly employed; there is, consequently, no heating, no inordinate wear and tear, and no loss of power. Equally ingenious is the construction of the proposed air pumps. Very large volumes of air are wanted to accompany and press forward the train—several hundred thousand cubic feet per minute. And what is the nature of the pumps to supply these? Are they to be blast engines? No; they are to be air pumps, in the shape of gasometers. We are all familiar enough with the sight of gasometers, but their application for such a purpose is certainly new.

We find throughout the work the same invincible spirit which seems to seek a difficulty for its immediate destruction. That a permanent railway across the English Channel will be built, we doubt not; we are equally confident that Messrs. Bateman and Révy's scheme is a practicable solution of the problem. No less an authority than the Emperor Napoleon III., after mature consideration of the scheme, wrote to say:—"*C'est le seul realisable,*" and as the design is one that belongs essentially to England, His Majesty's opinion acquires enhanced value and importance. Let us, then, hope that the engineering and enterprising powers of this eminently engineering country will heartily support, advance, and improve the plan, which seems to ensure inestimable advantages to England and France.

NOTES

THE Secretaries of the Royal Astronomical Society have circulated the following notification. "We are instructed to communicate to you the following Resolution, which was passed at a Committee of the Council held yesterday, April 8th:—Resolved—'That the Fellows be informed that there is a possibility of the Government providing means of transit to and from stations on the Mediterranean for about sixty observers, who may be willing to take part in the Observation of the Total Eclipse of December 22, 1870; and that persons willing to undertake a portion of the Observations on a plan to be arranged by the Council, be invited to send their names to the Secretaries, and also to state the branch of observation which they would be prepared, or prefer, to undertake, and the instruments they would be willing to contribute.' It is desirable that the names of those who are willing to take part in the observation of the Eclipse should be sent in, if possible, before the next meeting of Council, May 13."

WE are informed that M. Fahnehjelm, the Swedish Commissioner for the forthcoming series of Annual International Exhibitions, has applied for permission to exhibit a full-sized model of a school-room, just as it exists in the country parishes in Sweden, with all the books, maps, apparatus, forms, desks, &c., in order to give a complete idea of the Swedish system of elementary instruction. Her Majesty's Commissioners will, there can be no doubt, gladly place a sufficient space at the disposal of the Swedish Commissioner for so interesting an exhibit. It is to be hoped that encouragement will be given to other countries to follow this excellent example. An easy comparison of international appliances for educational purposes would be most useful to visitors to the Exhibition, and would be beneficial and stimulating to the countries exhibiting.

YET another contribution to Mr. De Morgan's "Budget of Paradoxes." A pamphlet reaches us under the title of "The New System of Astronomy" by "Incognito" (Spon, Charing Cross), reviving, as "more in accordance with ascertained observations, and more capable of exact proof than any yet propounded," the old idea that the earth is the centre of our system, the sun revolving round it in an orbit intermediate between those of the Moon and Mars, with Mercury and Venus as his satellites.

PROFESSOR H. J. CLARK, of Lexington University, Kentucky, sends us a paper entitled "Polarity and Polycephalism, an essay on Individuality." He applies the term "polarity" to the tendency of the vertebrate individual to arrange its organs in two opposing sets, cephalic and caudal, and again dorsal and ventral. An individual is generally understood to be a monocephalic being. In the case of so-called "alternation of generation" among the Acalephic, since the sexual and sexless are necessary to make up a distinct organism, *i.e.*, vegetative and reproductive, the one a completement of the other, neither alone can represent the individual unit or whole cycle of life; and cephalism is therefore, Professor Clark contends, a better term to indicate the potentiality of these subdivisions to live apart.

MR. T. PAYNTER ALLEN reprints from the "Journal of the Society of Arts" an Inquiry into the existing state of education in Richmond, Twickenham, and Mortlake. He finds that of the whole number of children in the district, one-third are absolutely uninstructed, scarcely one half are in average attendance at school, one-fifth alternate attendance at school with fluctuating labour injuriously to themselves and to the school; one-sixth are of the maximum school age without having reached the maximum of proficiency, and above one-half are children of eight years, and therefore in training in infant or mixed schools, the classification, methods, and teaching power of which are very imperfect and inferior.

PROFESSOR PIAZZI SMYTH publishes "A Poor Man's Photography at the Great Pyramid in the year 1865." The "poor man" is Professor Smyth himself, who details the difficulties encountered in pursuit of his undertaking in the face of a "coalition of rich ones against him." Whatever may be thought of Professor Smyth's theory of the object for which the Great Pyramid was built, there can be no question that he has brought to the subject an immense amount of patient self-denying research which demands acknowledgment, and some of his meteorological observations may yet lead to important results.

MESSRS. LONGMAN'S latest list of forthcoming works includes the following, in different departments of science:—The Origin of Civilisation, and the Primitive Condition of Man, by Sir John Lubbock; Other Worlds than Ours, by R. A. Proctor; The Historical Geography of Europe, by E. A. Freeman; Le Maout and Decaisne's General System of Descriptive and Analytical Botany, translated by Mrs. J. D. Hooker; Researches on Diamagnetism and Magnecrystallic Action, by Professor Tyndall; Lectures on Surgical Pathology, by James Paget; A Course of Elementary Problems in Practical Plane Geometry, by John Lowres; Principles of Mechanism, by Professor Willis; Smoking Fires—their Cause and Cure, by Rev. A. C. Ainslie; On the Manufacture of Beet-root Sugar in England, by W. Crookes; and A Handbook of Dyeing and Calico-printing, by the same author.

THE continental subscription list on behalf of the late Professor Sars now exceeds 10,000fr. A young naturalist, Mr. C. Jobert, called a public meeting at Havre in its support, which was a great success, the mayor granting free use of a room in the Hotel de Ville, and the printer refusing to be paid for printing the circulars: a worthy example for imitation.

Apropos of Professor Tyndall's "Dust and Disease," we extract the following from the *Scientific American*:—"The dust obtained from the places of amusement in New York has recently been analysed by the scientific officers of the Metropolitan Board of Health. Over one hundred speci-